COMPUTER KEYBOARD HAVING A SINGLE KEY PROVIDING A SHIFT-TAB FUNCTION

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BACKGROUND OF THE INVENTION

1. Field Of The Invention

The present invention relates to computer keyboards, including the nature of keys provided on the keyboard, the layout of those keys, and the functionality provided by those keys in relation to the computer system.

2. Description Of The Prior Art

Computer keyboards have become standardized in their basic format for use with a variety of computers and computer operating systems. In particular, this document refers to computer keyboards compatible with computers designed according to Microsoft Corporation hardware specifications and the Intel Corporation microprocessor and system design (so called Wintel computers, an acronym referring to Microsoft Windows and Intel Corporation), and to keyboards compatible with computer operating systems capable of running on these computers, including the various Microsoft operating systems and varieties of the Unix operating system, especially Linux and its derivatives.

The following section describes the evolution of the computer keyboard from the introduction of the original IBM PC to today's current versions, and describes the function of the major keys and key groupings.

83-Key PC/XT Keyboard Layout

As illustrated in Fig. 1, the very first PC keyboard was the 83-key keyboard produced by IBM for the very first IBM PCs and PC/XTs in the early 1980s. This design was copied nearly verbatim by most of the early PC "clone" makers, and was the standard for PCs of this era. From a layout standpoint, however, there are numerous problems with the original 83-key layout, which caused many typists a great deal of frustration. Here are some of the main issues with this layout, when it is contrasted to more modern configurations:

- **Cramped Physical Grouping:** It is a very "cramped" layout. All of the keys except the function keys are physically contiguous, giving the layout a very "busy" appearance. This is made worse by the fact that many keys are of odd sizes, and there is no clear vertical "dividing line" for the eye between the main typing area and the numeric keypad. Even the function keys are not separated very much from the rest of the layout. Overall, it looks like a "jumble of keys". This may seem a trivial matter but has an impact on those learning to use the PC.
- **Poor <Shift> Key Size and Location:** The <Shift> keys are rather small, and even worse, there is an extra key (backslash and vertical bar) between "Z" and the left <Shift> key, causing touch typists to accidentally hit this extra key when reaching for the left <Shift> key.
- **Poor <Enter> Key Size and Location:** The <Enter> key is also rather small, and too far to the right, with an extra, rarely needed key (back-quote and tilde) between the main typing area and the <Enter> key. The <Enter> key doesn't line up vertically with the right <Shift> key.

- **Strange <Ctrl> Key Size and Position:** Many users found the <Ctrl> key to be too large and in the place where they expected to find the <Caps Lock> key. In turn, the <Caps Lock> key is in an odd location.
- **No Dedicated Cursor and Navigation Keys:** The only cursor and navigation keys are the ones on the numeric keypad. Since the cursor and navigation keys are needed almost all the time, this greatly reduced the utility of the numeric function of that keypad. (Remember that *the* most popular application in the early days of the PC was Lotus 1-2-3, a spreadsheet program used by financial people who needed both cursor movement keys and the numeric keypad.)
- **No Indicator LEDs:** These early keyboards communicated unidirectionally with the system and could not accept the commands now used to control the indicator LEDs, so they included none. This caused much confusion, particularly given the frequency with which the <Num Lock> key needed to be pressed in order to flip between the cursor keys and the numeric keys. Some PC clone keyboards came out with indicator LEDs on them that were controlled by the keyboard itself to indicate the status of the <NumLock>, <CapsLock>, and <ScrollLock> keys. These mostly worked OK, but had the potential for becoming "out of sync" with what the system thought the state of the toggle modifier keys was.
- **Left-Side Function Keys:** Many users disliked having the function keys on the left hand side of the keyboard, principally because early software would often provide visual cues on the bottom of the screen indicating what roles the different function keys would play in that application, and users wanted to see the function keys "line up" with these cues.

84-Key AT Keyboard Layout

IBM received a lot of complaints about the first keyboard design and eventually made improvements to it. The first evolution of the keyboard was the 84-key keyboard layout introduced with the first IBM PC/AT, illustrated in Fig. 2. (The LED indicators are above the numeric keypad and not shown in this photo.) This is sometimes called the *AT Keyboard*. There are several definite improvements with this layout, compared to the 83-key keyboard:

- **Better Physical Grouping:** The keyboard has three distinct key physical groups, with the numeric keypad placed distinctly to the right. The three groupings have clean vertical lines. The numeric keypad has been reorganized. Overall, the keyboard has a much more organized and understandable appearance.
- **Improved <Shift> and <Enter> Keys:** The left <Shift> key, and the <Enter> key, have been enlarged, and the seldom-used "intervening" keys relocated.
- **LED Indicators:** With the new internals of this keyboard (see below), LED indicators for the "lock" functions were added.
- **Extra "System Request" Key:** This is the "84th key". It was mostly used for special control operations for PCs operating in communication with mainframe computer systems.

However, many of the layout issues with the original design remained. The biggest concern that remained unaddressed was the continued sharing between the numeric keypad, and the cursor and navigation keys. The function keys are still on the left-hand side, and the <Ctrl> and <Caps Lock> keys are still different from what a typist would expect.

This keyboard was changed internally from the PC/XT model as well. The interface was made □i-directional, allowing the system to send commands to the keyboard, and enabling the control of the new LED indicators. The signaling and interface protocols

created with this first PC/AT keyboard are still used today, even though the 84-key layout is no longer used, having been replaced by the "Enhanced" 101-key keyboard.

101-Key "Enhanced" Keyboard Layout

In 1986, IBM introduced the IBM PC/AT Model 339. Included in this last AT-family system was the new Enhanced 101-key keyboard illustrated in Fig. 3. This 101-key keyboard would become the de-facto standard for keyboards through the current day. Even today's 104-key Windows keyboards and variants with extra buttons and keys are based on this layout. The "Enhanced" keyboard was electrically the same as the 84-key AT keyboard, but featured a radically redesigned key layout. The major changes included these:

- **Dedicated Cursor and Navigation Keys:** Finally, separate keys were provided for cursor control and navigation. This enabled the numeric keyboard to be used along with the cursor and navigation keys. The cursor keys were also made into an "inverted-T" configuration for easier movement between the "Up" key and the "Down" key with a single finger.
- **Relocated Function Keys:** The function keys were moved from the left-hand side of the keyboard to a row along the top, and divided into groups of four for convenience.
- **Extra Function Keys:** Two additional function keys, <F11> and <F12> were added to the keyboard.
- **Relocated <Esc> and <Caps Lock> Keys:** The <Esc> key was moved back to the left-hand side of the keyboard, and placed up above the main typing area. The <Caps Lock> key was moved above the left <Shift> key.
- **Extra <Ctrl> and <Alt> Keys:** Additional <Ctrl> and <Alt> keys were added on the right side of the <Space Bar>.

- **Extra Numeric Keypad Keys:** The numeric keypad was fitted with an additional <Enter> key, as well as the "/" (divide operator) that had been missing up to that point.

Compared with the 84-key keyboard the Enhanced keyboard layout was perceived by most users to be far superior. It was an immediate hit despite its one obvious inferiority to the AT keyboard due to the smaller main <Enter> key.

With these improvements, the 101-key keyboard layout became the standard, and was modified only slightly by the nearly identical 104-key Windows keyboard which is the standard now. Although the 101-key/104-key designs are the "standard", some manufacturers have introduced variations of the basic design to make minor improvements. For example, a common modification is to enlarge the <Enter> key back to its "84-key layout size", and squeeze the backslash / vertical-pipe key between the "=/+" key and the <Backspace>.

102-Key "Enhanced" Keyboard Layouts

Several slightly modified versions of the regular American English 101-key Enhanced keyboard were created by IBM for by non-English PC users. These keyboards are virtually identical to the regular 101-key Enhanced keyboards, incorporating just slight differences from the regular U.S. keyboard. Considering the United Kingdom layout as an example, the following changes have been made:

- The regular number "3" key now yields "£" instead of "#" when shifted.
- The back-quote key yields the "¬" (horizontal bar) symbol when shifted instead of a tilde ("~").

- The main <Enter> key has been enlarged; it is now L-shaped again (though upside-down}
- An extra key (the 102nd) containing the supplanted "#" and "~" symbols has been added to the left of the main <Enter> key. (This seems a step backwards given the complaints about an extra key in this location in the 83-key layout.)
- Another step backwards: the backslash / vertical bar key has been relocated back to its former place--to the right of the left <Shift> key.

104-Key "Windows" Keyboard Layout

As Windows became the predominant operating system in the PC market, Microsoft realized that many common Windows functions had no simple keyboard short-cuts to activating them. Seizing their leadership position, they created a specification for a new variant of the 101-key keyboard that includes special keys to activate common Windows functions. This design is the 104-key "Windows" keyboard, illustrated in Fig. 4.

This layout is identical to the 101-key Enhanced layout with the exception of the additional three keys: one Windows key on either side of the <Space Bar>, and a Windows context menu (right-click) key to the right of the <Space Bar>. This layout makes room for them by stealing real estate from the <Alt>, <Ctrl> and <Space Bar> keys along the bottom of the keyboard. In addition to the new Windows keys, the particular keyboard model shown in the illustration of Fig. 4 incorporates the larger main <Enter> key, enabled by moving the backslash/vertical pipe key up one row, placed next to the now-smaller backspace key. Although the particular model as shown incorporates this <Enter> key modification, the majority of Windows keyboards on the market incorporate the <Enter> key layout of the 101-key Enhanced keyboard. The functions of the two types of Windows keys are as follows:

- **"Windows" Keys:** Two keys, one to the left of the <Space Bar> and one to the right, are used to activate various functions within the operating system. If either is pressed by itself, it puts the Windows task bar in the foreground and opens the Windows start menu. (Note that this is identical to the function performed by the key combination <Ctrl>+<Esc>). The Windows keys are also like modification keys, as they enable several "short cut" actions through special key combinations such as opening the Windows Explorer by simultaneously pressing a Windows key and the <E> key.
- **Context Menu Key:** This key, on the right-hand side of the keyboard, is used to simulate right-clicking the mouse at its current location. Under standard Windows functionality, this opens up a context menu of commands relevant to the Window or object the mouse was over at the time the key was pressed.

Since the Windows keyboard offers some flexibility that the regular Enhanced layout does not, and its cost of production is virtually unchanged, it quickly replaced the Enhanced layout as the de-facto standard on most PCs. Most keyboards today, whether they are included with new PCs or sold separately, are some variation of the 104-key Windows keyboard layout.

Modern 104-key Windows Keyboards with Special Purpose Keys

Many specialty keyboards have extra keys or buttons, above and beyond the keys normally found on "standard" keyboards. These are becoming increasingly popular as companies look to provide convenience features on the keyboard, and possibly differentiate their offerings from those of competitors. Keyboards dubbed "Internet keyboards" or "multimedia keyboards" usually have at least some of these extras.

These special keys are usually provided in addition to the regular 104 keys of a standard Windows keyboard, squeezed in along the top of the keyboard or on the right-hand or left-hand side. They of course differ by keyboard type, however, they commonly fall into the following categories.

- **Internet Shortcuts:** A series of buttons to implement common Internet functions, such as connecting to the 'net, or opening a web browser or email software.
- **Audio Controls:** Buttons that let you raise or lower your PC's sound volume, mute the sound, and so on. Some also include buttons that implement standard CD player functions: start/stop, pause, next, previous and such. Some include a rotary volume control.
- **Mouse Controls:** Buttons that simulate movement of the mouse, or mouse clicks.

An example of a 104-key Windows keyboard with additional special purpose keys is illustrated in Fig. 5. This Hewlett-Packard keyboard is just packed with extra buttons and features. These include numerous Internet buttons, audio controls, CD player controls, and a rotary volume control (visible in the upper right hand corner).

Programmable keyboards which allow the user to define the role of individual keys also typically have extra keys, which are used to enable programming modes. Also, some foreign-language keyboards have additional keys corresponding to special characters required for those languages.

Since "extra" keys are non-standard and differ for each keyboard, special drivers or software are required to enable the special functions. Otherwise, the operating system won't know what to do with the unexpected, non-standard scan codes, and will probably just ignore them. More popular keyboards may have support built into Windows, and some foreign-language keyboards may also have native support. Otherwise you will need driver software from the maker of the keyboard.

Description of the Major Types of Keys

This section describes the purpose and operation of the major types of keys found on the 101-key and 104-key standard keyboards. The primary typographic keys include the following:

- **Alphabetic Keys:** The keys A through Z. Regular keypresses produce lower-case letters, and shifted keypresses create upper-case letters. <Caps Lock> reverses the <Shift> key functionality.
- **Numeric/Punctuation Keys:** These are the numeric keys along the top of the keyboard, above the alphabetic keys. Shifted, they produce various punctuation and special symbols. The numerics are pretty much universal on English-language keyboards; the punctuation symbols can be different depending on region. For example, the "#" key in the United States is a "£" symbol in the United Kingdom.
- **Other Main Punctuation Keys:** Most of the other punctuation keys on the keyboard are located just to the right of the alphanumeric keys mentioned above. While they have special meaning in some software applications, they are "just characters" most of the time.
- **"White Space" Keys:** These include the primary (main) <Enter> key, the <Tab> key and the <Space Bar>. These keys are used for formatting text, and to delimit text entries and commands. Collectively they are often referred to as "white space" since they are characters that separate "real" characters without containing any information in and of themselves. There is also a secondary <Enter> key that is part of the numeric keypad.
- **<Delete> and <Backspace> Editing Keys:** In text-based applications--or in text fields within other applications (for example, a Web browser)--these keys are usually used in conjunction to allow deleting of characters. The standard followed

in most software is that the <Delete> key removes a character to the right of the insertion point, and the <Backspace> key removes a character to the left of the insertion point. In other contexts such as word processors and email programs, the <Delete> key may be used to delete or remove any type of object; in these applications, regions of text and objects may be selected, for example, by using the techniques described for the <Shift> key, and then deleted by pressing the <Delete> key.

One of the most important advances of the new 101-key "Enhanced" keyboard created by IBM was the creation of separate, dedicated cursor-control and navigation keys. These had formerly been accessible only by using the numeric keypad. On modern keyboards these important keys are generally placed between the numeric keypad and the main typing area. The cursor control and navigation keys are also still also available using the numeric keypad, of course, but this is rarely used today. This set of keys includes the following:

- **Arrow Keys:** These keys permit motion in most software programs in any of the four standard directions that exist in two dimensions: up (north), down (south), left (west) and right (east). In many programs these perform functions similar to those that a mouse does, simulating two-dimensional movement. Some keyboards actually have *eight* arrow keys; the additional four keys are diagonals that correspond to the "northwest", "northeast", "southwest" and "southeast" directions. The default arrangement is an "inverted-T" configuration. Some keyboards may use instead a "diamond pattern", with the up arrow key higher.
- **<Page Up> and <Page Down>:** These keys (sometimes labeled "PgUp" and "PgDn") are used in software programs primarily for one-dimensional scrolling, for

example, to go up or down one page in a spreadsheet program, word-processing document, Web page and so on.

- **<Home> and <End>:** The <Home> key is usually used to go to the left side of the current line in a document, and the <End> key to the right side. The current line is the line of text having the active cursor, meaning the location on screen where the next keyboard action will take place.

The keyboard contains several keys that serve primarily to alter the function or meaning of other keys. They are often used in combination with another key (typically by holding them down and then pressing the other key) or are typically used to set a particular keyboard state. These will be referred to as *modification keys*, grouped into two different sub-categories. The first are *temporary* modification keys, because they modify other keys only while held down. This includes:

- **<Shift> Keys:** These two keys are near the bottom of the keyboard, one on either side of the main typing area. They enable access to capital letters, and also to the "alternate" functions printed on the keycaps above the unshifted symbol or function shown. So for example, holding the <Shift> key down and pressing the equal sign ("=") generates a plus sign ("+"). The <Shift> keys also change the behavior of the function keys in most software programs; for example, <Shift>+<F6> is different than just <F6>. The <Shift> key functions within Windows applications to create a selected region of text or objects (or both) when used in conjunction with the navigation keys; holding the <Shift> key down while simultaneously pressing an arrow key, the <Home>, <End>, <Pageup>, or <PageDown> keys will create a selected region. A selected region can be deleted with the <Delete> key, or can be moved, copied or have other actions performed on it according to the capabilities of the software application being used.

- **<Ctrl> Keys:** These are the "control keys"; one is located on either side of the typing area. Sometimes the keycap says "Control" instead of the shortened "Ctrl". These keys are used in combination with regular alphanumeric keys and also the function keys to control special features and functions in software programs.
- **<Alt> Keys:** These are the "alternate control keys". They operate the same way the <Ctrl> keys do; their presence just lets complex software have more options. For example, <Alt>+<F6> can be a different function than <Ctrl>+<F6>. The <Alt> keys are also used for ASCII code generation.
- **<Insert>:** In modern computing systems this key functions as a toggle key to switch between the normal "insert mode", where all typed characters are automatically inserted, and "replace mode", where typed characters replace those at the text insertion point. Historically it was used to insert a space in a text area each time it is pressed, but that usage is now rare.

The temporary modification keys can be combined if held down. For example, holding down <Shift>+<Ctrl>+ the up arrow in the Microsoft Word application will select the entire current paragraph.

The second sub-category contains *locking* modification keys. These are *toggle* keys – they change the function of other keys until they are pressed again to cancel the effect:

- **Caps Lock:** When pressed, causes the function of the <Shift> keys to be reversed, but only for letter characters; other keys are unaffected. When active, the Caps Lock LED will be lit.
- **Num Lock:** Enables the numbers on the numeric keypad when activated, and lights the Num Lock LED as well. When not active, the numeric keypad's keys generate cursor-control functions instead. This functionality dates back to the earliest PCs, which did not have dedicated cursor-control keys; today the cursor-control

functions on the numeric keypad are redundant, which is why many people leave Num Lock always enabled.

- **Scroll Lock:** Lights the Scroll Lock LED and causes some software programs to alter their behavior when certain other keys are pressed. In particular, when Scroll Lock is active, the cursor keys are often used to scroll the visible document rather than change position within it. This is not used nearly as much as the other two.

Lastly, the 101-key and 104-key keyboards include some miscellaneous keys not easily categorized; they are:

- **Function Keys:** The *function keys* are a set of twelve numbered keys that are used by different software programs for a variety of different purposes. They are sometimes called *programmable function keys* or just *F-keys* or *PF-keys*. The original PC keyboard designs had 10 function keys, arranged in a 2x5 matrix on the left-hand side of the keyboard. With the introduction of the 101-key Enhanced keyboard, this was expanded to 12 keys, which were moved to a single row along the top of the keyboard. The exact duty of the function keys depends entirely on how the software chooses to interpret them.
- **<Escape>:** The Escape key is usually used as an "exit" key of sorts by programs, to cancel commands or get out of something. It is also used in some contexts to change the meaning of subsequent characters.
- **<Print Screen / Sys Rq>:** When pressed from DOS, this key causes the contents of the current screen of text to be sent to an attached printer. From within Windows, it copies the contents of the screen, in graphical format, to the Windows clipboard. The alternate use of this key is for the "system request" function. This is a historical command originally based on older IBM terminal designs, and is not really used any more.

- **<Pause / Break>:** When pressed by itself, pauses the display or operation of some software programs. When pressed in combination with the <Ctrl> key, sends a "break" command that will interrupt some software programs or DOS commands. (You can do the same thing with <Ctrl>+C).

Key Groupings

The 101-key and 104-key keyboards are divided into seven major key groupings. Referring to **Fig. 3**, they are: a) the main alphanumeric (typewriter) section 20; b) the numeric cluster 22; c) the function keys 24; d) the Escape key 26; e) the arrow cluster 28; f) the miscellaneous key group 30 comprising <PrintScreen>, <ScrollLock>, and <Pause>; and g) the navigation key group 32 comprising <Insert>, <Delete>, <Home>, <End>, <PageUp>, and <PageDown>.

Prior Art Deficiency and Opportunity for Improvement

As reported in the preceding narrative, there has been development and advancement in the design, functionality, and usability of the computer keyboard over the last two decades, driven primarily by deficiencies and difficulties experienced by the user community. However, not all needs and opportunities for improvement have been entirely obvious to previous developers, and the pretext of this patent application is that there remains room for improvement.

The basic keyboard layout has not changed since the introduction of the mouse, although the usage of a mouse creates specific changes in the ways that the hands are utilized in manipulating the combination of the keyboard and mouse. Most right-handed people, and even many left-handed people, use the mouse with their right hand. The

keyboard layout, however, is not symmetric, and there are three "important" keys which are only available on the right side of the keyboard: these are the <ENTER>, <DELETE>, and <BACKSPACE> keys. These are "important" keys in that they are used in editing operations in cooperation with the mouse. As a consequence of this layout in conjunction with the right-handed mouse usage, the user's right hand must move back and forth between the mouse and the keyboard in order to position the mouse cursor and then operate one of those three keys, even though the user's left hand is idle.

Fig. 6 is an illustration of a Microsoft Corporation product called the Office Keyboard 40 which incorporates several buttons to the left side of the main keyboard, with the specific intent of enabling the left hand to function cooperatively while the right hand manipulates the mouse. The functions that these buttons perform include online browser operations of "forward" 42, "back" 44, a scroll up/down wheel 46, editing functions of "cut" 48, "copy" 50 , and "paste" 52, and a button to switch between open applications 54. While these new buttons do offer the user an opportunity to perform functions with the left hand while the right hand is manipulating the mouse, they nevertheless fail to accommodate the very common needs encountered while editing, in particular in relation to the <ENTER>, <DELETE>, and <BACKSPACE> keys.

The numeric keypad, which was designed for numeric data entry, bears elements in common with the standard desktop calculator but omits other important elements. There are a variety of available software applications that emulate the functions of a desktop calculator, and which will take their input from the computer keyboard and in particular from the numeric cluster. However, since important calculator elements are missing from the numeric cluster, the combination of a PC with a 101-key/104-key keyboard incorporating a numeric cluster and calculator emulation software is not quite suitable for use as an alternative to the desktop calculator.

The Microsoft Corporation Office Keyboard, referenced previously as Fig. 6, incorporates several changes and additions to the numeric cluster. Fig. 7 illustrates the numeric cluster of this keyboard. The <NUM LOCK> key is replaced with a <TAB> key 60, and the alternate use of the numeric cluster as a cursor cluster is omitted. There is a new row of keys approximately one-quarter inch above the numeric cluster incorporating an <EQUAL SIGN> key 62, a <LEFT PARENTHESIS> key 64, a <RIGHT PARENTHESIS> key 66, and a <BACKSPACE> key 68.

While these new buttons do offer some additional calculator functionality, nevertheless significant calculator elements still remain missing. Even the combination of a PC with a Microsoft Office Keyboard and calculator emulation software is not quite suitable for use as an alternative to the desktop calculator, as users must flip back and forth between the numeric keypad and the mouse.

Lastly, Shifted key operations require two hands, one to operate the Shift key and the other to operate the desired character or function key. The Tab is used extensively in spreadsheet operations to move from the active cell to the next cell to the right, and Shift-Tab is used to move to the left. In some word processing and editing applications, the Tab key indents the current line of text, and Shift-Tab out-dents the current line of text. The Tab function would be more useful if there were a single key operation that could perform the reverse-direction movement.

Because of the deficiency of the current keyboard design, there remains a need in the art for a keyboard design having a single-key means to perform the Shift-Tab and other Shifted key functions, having editing keys for left hand operation, and having full calculator functions available from the numeric keypad.

SUMMARY OF THE INVENTION

The present invention enhances and extends the inventive matter of the two referenced Continuation-in-Part patent applications through the addition of, and the placement of, a single key to perform the Shift-Tab function.

The present invention provides a simple means for computer users to perform the Shift-Tab function by providing a single Shift-Tab keyboard key which performs both the function of the operating the Shift key and the Tab key simultaneously. Typing the Shift-Tab key performs the reverse operation of the Tab key, and since the Shift-Tab key is only a single key, it requires only a single hand to operate it. In general, keys that implement the function of pressing multiple keys simultaneously are not novel and are common among programmable keyboards. However, the present invention is the combination of both the operation and the placement of a Shift-Tab key that results in a unique benefit to the users of computer keyboards.

The Tab key has several common functions, many of which can be performed in reverse by the simultaneous operation of the Shift key with the Tab key. In its original form on a typewriter, the Tab key moved the carriage to the right to a mechanical index marker, typically set at one-half inch, allowing the leading line of a paragraph to easily be indented. The implementation of the Tab key on computer keyboards continues with that simple function, but it is also used to implement functions that seem conceptually similar, that is, moving the on-screen cursor in larger increments than just single character spacings.

The Tab key, for example, moves the cursor from one word processing table cell to the next, or one spreadsheet cell to the next, moving from left to right. Those movements can be made in reverse, that is, moving the cursor from right to left, by operating the Shift key and the Tab key concurrently. However, the Tab movement can be operated with one

hand (the left hand), but the Shift-Tab movement requires two hands - the left hand to operate the Tab key and the right hand to operate the Shift key.

In general it is more desirable to have a function respond to a single hand or single key press. In the case of the Tab key, it is of ergonomic significance because frequently the right hand will be entering numerical data from the numeric keypad, while the left hand moves the cursor from cell to cell. To move backwards to the previous cell requires that the right hand leave its position over the numeric keypad to find the Shift key, and then to move back to the numeric keypad. There are no tactile references that can guide the right hand in these moves, and so the user must divert their eyes from the screen to the keyboard to move the right hand from the numeric keypad to the Shift key, and then again to move the right hand from the Shift key back to the numeric keypad.

Consequently, there is a value in having a left-hand operable single key that performs the Shift-Tab function. In one version of the preferred embodiment, this key is located just to the left of the Tab key, in the same horizontal row. This placement has the intrinsic value of the rightmost of these two keys moving the cursor to the right, and the leftmost of these two keys moving the cursor to the left.

This placement further benefits from the referenced patent application 10/427,856, incorporated herein in its entirety by reference, of which this application is a Continuation-in-Part, which advances the concept of left hand copies of the Enter, Delete, and Backspace keys, to be located immediately to the left of the main keyboard keys. A preferred arrangement is to locate these keys in a vertical row. This preferred arrangement further benefits from the inclusion of a Shift-Tab key in the same vertical row, and wherein the Shift-Tab key is immediately to the left of the Tab key and in the same horizontal row as the Tab key.

The referenced patent application 10/427,535, incorporated herein in its entirety by reference, of which this application is a Continuation-in-Part, advances the concept of a

more functional numeric keypad having calculator keys that operate calculator functions in an on-screen calculator emulation software program. This keypad is further enhanced by the incorporation of the Shift-Tab key, paired with a Tab key, so that the user's right hand can move the cursor from cell to cell in either direction with a single keystroke. There are many ways in which the keys of such a numeric keypad could be laid out, but in any such arrangement the preferred embodiment of the Shift-Tab and Tab keys is with both keys in the same horizontal row, the Shift-Tab key being the left-most of the two keys, and the Tab key being the right-most of the two keys.

Laptop computers have a small form-factor keyboard with a numeric keypad shared on the alphabetic keys and accessible by the operation of a function key which acts like a special shift key. This arrangement suffers in usability and so many manufacturers offer a separate numeric keypad having a Universal Serial Bus (USB) connection to the PC. Such a device can, in concept, be used with any PC, although appropriate driver software may be required. Operationally it is as if the keyboard comes as two separate pieces -- there is no difference in function, only in ergonomics.

The numeric keypad of the present invention, having calculator keys that operate calculator functions, is well suited to implementation in such a stand-alone numeric keypad.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be more fully understood when reference is had to the following detailed description of the preferred embodiment of the invention and the accompanying drawings, in which:

Fig. 1 is an illustration of the 83-key original IBM PC keyboard;

Fig. 2 is an illustration of the 84-key IBM PC/AT keyboard;

Fig. 3 is an illustration of the 101-key Enhanced IBM keyboard;

Fig. 4 is an illustration of the 104-key "Windows" keyboard;

Fig. 5 is an illustration of a contemporary "multimedia" keyboard;

Fig. 6 is an illustration of the Microsoft Corporation "Office Keyboard";

Fig. 7 is an illustration of the numeric keypad of the Microsoft "Office Keyboard";

Fig. 8 is an illustration the main portion of a standard 104-key keyboard, showing the preferred embodiment of left-hand editing keys in a vertical row to the immediate left of the main keyboard keys, and incorporating a Shift-Tab key to the left of the Tab key;

Fig. 9 is an illustration of a numeric keypad portion of a keyboard incorporating both a Tab key and a Shift-Tab key;

Fig. 10 is an isolated view of the numeric keypad portion of Fig. 9; and

Fig. 11 is another isolated view of the numeric keypad with the portions unchanged from conventional designs being removed for clarity.

DETAILED DESCRIPTION OF THE INVENTION

The present invention provides a simple means for computer users to perform the Shift-Tab function by providing a single Shift-Tab keyboard key which performs both the function of the Shift key and the function of the Tab key simultaneously. Thus, typing the Shift-Tab key performs the reverse operation of the Tab key; since the Shift-Tab key is only a single key, it requires only a single hand to operate it.

Fig. 8 illustrates one preferred embodiment of the present invention. Shown in Fig. 8 is an illustration of a typical 104-key "Windows" keyboard, showing the main portion of the keyboard with the addition of four editing keys in a vertical row immediately to the left of the main keyboard section. The new vertical row of editing keys is shown generally as 80, and the main section of the keyboard is shown generally as 90. The vertical row of editing keys is comprised of a Backspace key 82, a Shift-Tab key 84, a Delete key 86, and

an Enter key 88. The Shift-Tab key 84 is shown in opposition to the Tab key 92, such that they are adjacent to each other, are in the same horizontal row, with the Shift-Tab key being the left-most of the pair.

Fig. 9 illustrates a keyboard having an enhanced numeric keypad incorporating the inventive matter of the present invention and that of application No. 10/427,535 of which this application is a Continuation-in-Part. Fig. 9 illustrates the right portion of a standard 104-key keyboard having outside dimensions suggested by line 100 and showing the rightmost Function keys 102, the rightmost portion of the main key section 104, the cursor key section 106, and the numeric keypad section 110.

Fig. 10 isolates the numeric keypad 110 portion of Fig. 9. The numeric keypad is expanded in size from the conventional layout, having two additional horizontal rows 112 and 114, and three vertical rows 116, 118, and 120 above the cursor arrow keypad. These three new overhanging rows are accommodated by removing or relocating four keys that are now unnecessary, seldom-used, or unused. These keys include Print Screen, Scroll Lock, Pause, and Insert. The remaining keys that were resident in the same vertical grouping as the cursor arrow keys have been rearranged into the more useful cursor cluster 106. Dark line 122 highlights the portion of the numeric keypad carried over unchanged from conventional designs.

Fig. 11 again repeats the illustration of numeric keypad 110 by removing the unchanged portion 122 for clarity. The Calculator key 130 calls up the onscreen calculator emulation program; Clear key 132 clears any current calculations, whereas the Clear Entry key 134 clears a number presently being entered; 136 and 138 are the pairing of the Shift-Tab key 136 and the Tab key 138. Tab key 138, Backspace key 140, and Equal sign key 142 are also present on the numeric keypad of the Microsoft Office Keyboard of Fig. 7. Symbol Lock key 144 makes accessible additional symbol characters that may be co-resident on the numeric keypad keys as described in co-pending patent application Serial

No. 10/427,880 filed May 1, 2003. Calculation keys 146, 148, and 150 actuate the corresponding calculator functions of percentage, plus/minus, and square root, respectively. Keys 152 and 154 cause the calculator emulation program to activate calculator Sub-Total and Grand Total functions, as indicated on the key labels. Lastly, there are four memory function keys indicated by 156 which implement the standard calculator memory functions of Add to Memory (M+), Subtract from Memory (M-), Memory Clear (MC), and Memory Recall (MR).

Of these keys, the Calculator key 130, Symbol Lock key 144, Shift-Tab key 136, Tab key 138, and Backspace key 140 improve the usability of a numeric keypad by making their respective functions more readily available. All of the remaining keys (Memory keys 156, Clear keys 132 and 134, Total keys 152 and 154, Equal key 142, Percent key 146, Plus/Minus key 148, and Square Root key 150) directly implement calculator functions in cooperation with an on-screen calculator. The presence of these keys enables the numeric keypad to implement full desktop calculator functionality from a PC, and the calculator functionality is accessible with one hand, without requiring the use of a mouse. Of these keys, only the Equal key 142 has any presence in the prior art in being associated with the numeric keypad section of a computer keyboard.

Having thus described the invention in rather full detail, it will be understood that such detail need not be strictly adhered to, but that further changes and modifications may suggest themselves to one skilled in the art falling within the scope of the present invention as defined by the subjoined claims.